Software Product Maturity in SIS Source Selection

Childhood

Youth

Manhood

Old Age

Thomas Cole, <u>The Voyage of Life,</u> 1842, National Gallery of Art, Washington, DC

Richard Turner, **OUSD(AT&L)/DS/SIS (George Washington University)**
Acquisition of SIS Conference, January 28, 2004

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The Requirement

- **Section 804 of the '3 Defense Authorization Act requires that OSD**

"assist MILDEPs by ensuring criteria applicable to selection of sources provides added emphasis on
  - *Past performance of potential sources*
  - *Maturity of software products offered by potential sources"*

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Defining SW Product Maturity

- **No standard definitions/scales**
- **Not Software Technology Readiness Levels (TRL)**
  - **Maturity addresses a specific product**
  - **TRL addresses underlying technology**
- **Highly dependent on environment and application context**
- **Many dimensions of maturity**

The Approach

- **Gathered a group of experts to:**
- **Review existing approaches**
- **Develop characteristics and information sources**
- **Develop guidance for source selection**
- **Develop RFQ/RFP language**

Focus on Source Selection

- **General maturity problem is extremely difficult**
  - *Limited time and resources*
  - *Need for significant effort to work on development-based maturity*
  - *Some promising work (MDA, AF) but untried*
- **Source selection was the Congressional emphasis**
- **Source selection bounds the problem to measuring existing, working software (e.g. COTS, GOTS, legacy)**

Software in Source Selection

- **Many different kinds of source selections**
  - **Greenfield vs. Upgrade**
  - **Traditional business-process IT system implementation vs. Command and Control or embedded software**
- **Different kinds of software in programs**
  - **Only software that exists has determinable maturity**
  - **Aggregations of existent and non-existent software are common**

- **Software doesn't exist (Not measurable)**
  - **Developmental software**

- **Software exists (Measurable)**
  - **COTS**
  - **GOTS**
  - **Prototype**
  - **NDI/Legacy**
  - **Experimental**

Observations

- **Software product maturity is value-neutral**
  - Mature software not better than immature software in some instances; must be interpreted in light of risk
    - *Web-pages*
    - *Proofs of concept*
- **Software can become senile**
  - Collective impact of changes overwhelm the architecture
  - Environment changes
  - Utility degrades
- **Level of understanding of context directly impacts risk and interpretation of maturity**
  - Poorly understood application environment or target makes risk assessment difficult

Notional SW Maturity Lifecycle

Utility of Software

Technology Development

Product Development

Product Sustainment

Product Aging

Obsolescence

Science and Technology TRL 1-4

Alpha Release TRL 5

Beta Release TRL 7

Official Release TRL 8

Operational Installation TRL 9

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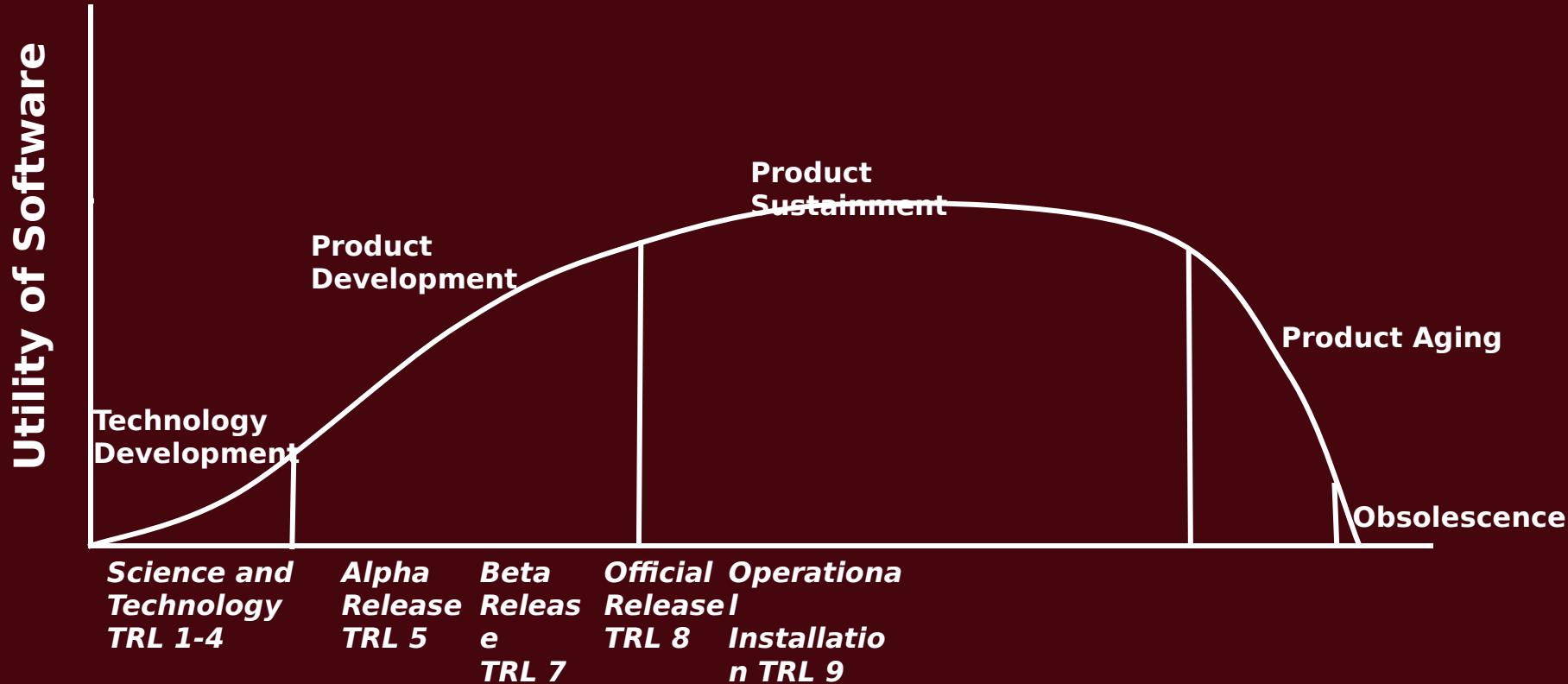
Candidate Characteristics

- **Represent areas/dimensions affecting product maturity**
- **Must be considered both separately and as a group**
- **Weight of each characteristic may differ in any particular situation**
- **Must be evaluated against intended purpose**

Candidate Characteristics

1. Understanding of the potential for latent defects within the product
2. Understanding of the domain of product applicability
3. Predictability of product behavior (within well-defined parameters)
4. Product stability
5. Product supportability
6. Product pedigree

Potential for Latent Defects

- **Addresses the risk of undetected bugs**
- **Possible measures or information sources**
  - **Test regimen**
  - **Test coverage**
  - **History and trends of types/frequency of faults**
  - **Certifications and test packages**

Domain of Product Applicability

- **Addresses risk of suitability of the product to the intended task**
- **Possible measures or information sources**
  - **Compatibility measures**
  - **Robustness (adaptability, scalability, portability, security, safety, integrity, etc.)**
  - **Availability and quality of design and maintenance documents**
  - **Certifications and test packages**
  - **Specific operational environment(s)**
  - **Limitations on product use**

Predictability of Product Behavior

- **Addresses the risks associated with suitability of operational and functional quality**
- **Possible measures or information sources**
  - **Test regimen**
  - **Test coverage**
  - **History and trends of types/frequency of faults**
  - **MTBF**
  - **Availability**
  - **Recovery from faults**
  - **Compatibility measures**
  - **Accuracy**
  - **Completeness of features/functions definition**

Product Stability

- **Addresses the risks associated with historic volatility that could re-emerge**
- **Possible measures or information sources**
  - **Release history and frequency**
  - **History and trends of types/frequency of faults**
  - **Obsolescence potential**
  - **Software aging characteristics**

Product Supportability

- **Addresses the risks associated with continuing suitability of the product**
- **Possible measures or information sources**
  - Availability of training
  - Availability of vendor/developer/consultant support
  - Recovery from faults
  - Mean time between failure
  - Availability and quality of design/maintenance documents
  - Dependency on events out of product control
  - Life expectancy
    - *First shipment date*
    - *End-of-life plans*
    - *Market share*
    - *Market trend*
    - *Rights granted on discontinuation of product*

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Product Pedigree

- **Addresses the risks associated with the developers/sources for the product**
- **Possible measures or information sources**
  - **Installed base**
  - **Market share**
  - **Market trend**
  - **Maturity of underlying software technology(ies)**
  - **Customer references**
  - **Confidence in adherence to standards**
  - **History of upward compatibility**

Additional Factors

- **Control over configuration/evolution**
  - **Does the acquisition need to determine when or how the product will change and the type of features that may be added or dropped?**
- **Predictability of evolution and obsolescence**
  - **Does the acquisition have a clear understanding of the direction and speed of product evolution and the time remaining in the product's likely supported life?**
- **Schedule**
  - **Does the acquisition understand when the product will be available or updated (such as availability of NDI or required product functionality)?**
- **Costs**
  - **Does the acquisition understand the full costs associated with the product, such as licensing, refresh, maintenance**

Additional Factors - 2

- **Architecture**
  - **Will the product require significant changes to an existing software architecture?**
- **Operational Context**
  - **Will the product fit the current or envisioned modes of operation, operational environment (e.g. platform) and process context?**
- **Fitness for use**
  - **Do the product characteristics meet the needs of the envisioned use (such as security, availability, and scalability)?**
- **Modification of product**
  - **Will there need to be modifications to the product that will prevent normal developer/vendor refresh?**

Additional Factors - 3

- **Release synchronization**
  - **Will the vendor release schedule impact operations?**
- **Pedigree of product developer**
  - **Does the acquisition have confidence in the developer/vendor (including disclosure of subcontractors)?**

Context Impacts Risk

Risk/Degree of Needed Assurance

NDI/COTS Single Solution

Single ⟶ Many users

Local ⟶ Enterprise-wide

Precedented missions ⟶ Unprecedented missions

NDI/COTS Aggregate

Peripheral to Mission ⟶ Central Element of mission

Precedented missions ⟶ Unprecedented Missions

Short System Operational Life ⟶ Long System Operational Life

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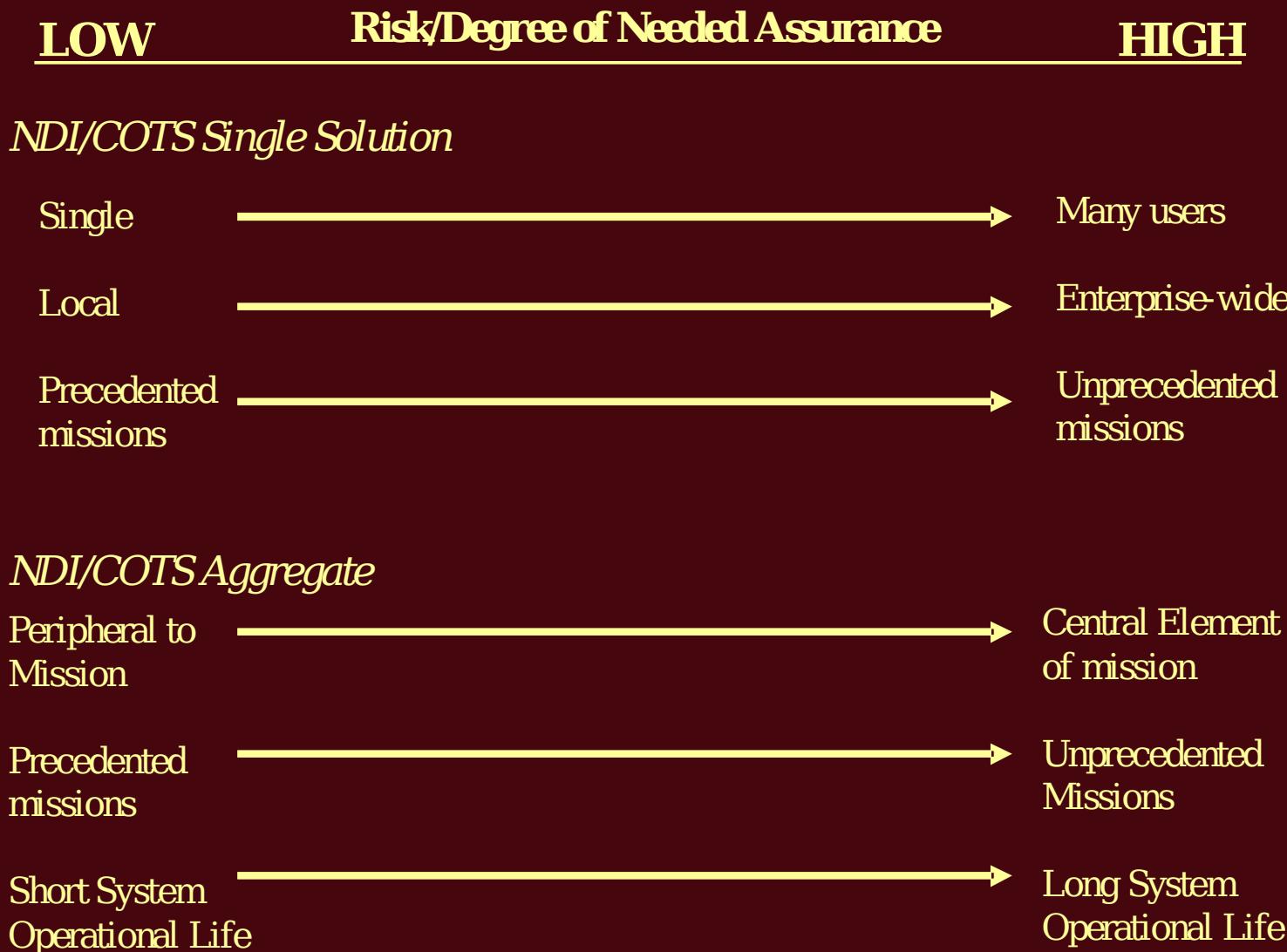
Summary

- **Maturity can only be measured on existing software**
  - **For source selection this means COTS, GOTS, NDI, prototype, experimental**
- **Initial set of software product maturity characteristics defined**
- **Maturity evaluation complex - dependent on context and related factors**
- **Next steps**
  - **Complete draft language for OSD Guidebook**
  - **Refine characteristics and measures**
  - **Continue to evaluate development maturity concepts**

Questions?

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